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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/603,132	06/23/2000	Brian A. Vaartstra	150.00650102	3538
7590 06/02/2004				
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		EXAMINER		
		LEE, EUGENE		
		ART UNIT PAPER NUMBER		
		2815		

DATE MAILED: 06/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/603,132

Applicant(s)

VAARTSTRA ET AL.

Examiner

Eugene Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 04 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 45-68 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 45-68 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

#### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114 was filed in this application after appeal to the Board of Patent Appeals and Interferences, but prior to a decision on the appeal. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 2/4/04 has been entered.

#### ***Specification***

2. The amendment filed 2/4/04 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: at least one of the ... second electrode comprises a chemical vapor codeposited diffusion barrier layer formed of  $\text{RuSi}_x$ . Also, note the pre-amendment filed 6/23/00 deleted line 20, page 3 through line 26, page 4.

Applicant is required to cancel the new matter in the reply to this Office Action.

#### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 50 thru 53 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification does not disclose at least one of the ... second electrode comprises a chemical vapor codeposited diffusion barrier layer formed of  $\text{RuSi}_x$ . The specification does disclose the first electrode comprising a chemical vapor codeposited diffusion barrier layer formed of  $\text{RuSi}_x$ , however, the specification does not disclose the second electrode comprising a chemical vapor codeposited diffusion barrier layer formed of  $\text{RuSi}_x$ .

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 45 thru 48, 50, and 51 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsubara et al. 5,122,923. Matsubara discloses (see, for example, Fig. 1) a capacitor (semiconductor device structure) comprising a silicon substrate (substrate assembly including a

surface) 1 and a lower electrode (diffusion barrier layer) 3. In column 4, lines 24-27, Matsubara discloses the lower electrode being made of layers of ruthenium, ruthenium oxide, ruthenium silicide and stacked structures.

Regarding claim 48, see aluminum electrode (one or more additional conductive layers) 5.

Regarding claims 50 and 51, Matsubara discloses (see, for example, Fig. 1 and column 3, lines 43-47) a capacitor structure comprising a lower electrode (first electrode) 3, dielectric layer (high dielectric material) 4, and upper electrode (second electrode) 5.

7. Claims 45, 46, 50, and 51 are rejected under 35 U.S.C. 102(e) as being anticipated by Kuroiwa et al. 6,239,460 B1. Kuroiwa discloses (see, for example, Fig. 10 and column 13, lines 12-14) a semiconductor device structure comprising a substrate (substrate assembly) 101 and a ruthenium silicide layer (diffusion barrier layer) 132.

Regarding claims 50 and 51, Kuroiwa discloses (see, for example, FIG. 10) a capacitor structure comprising a metal electrode (first electrode) 130/132, capacitor dielectric 115 and upper electrode (second electrode) 116. In column 13, lines 11-15, Kuroiwa discloses the ruthenium silicide layer 132 is formed from a portion of metal electrode 130.

### ***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 48, 49, and 54 thru 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 as applied to claims 45, 46, 50, and 51 above, and further in view of Aoyama et al. 5,852,307. Kuroiwa does not disclose a silicon containing region. However, it was well known in the art to use a substrate made of silicon (silicon containing region). Aoyama discloses (see, for example, FIG. 21D and column 15, lines 58-60) a capacitor structure on a silicon substrate 101. It would have been obvious to one of ordinary skill in the art at the time of invention to use a silicon containing region (making the substrate of Kuroiwa a silicon substrate) in order to form a semiconductor device and form diffused regions therein, and since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claims 48 and 49, see FIG. 10 wherein Kuroiwa discloses a metal electrode (one or more additional conductive layers) 130 and column 9, lines 39-42 wherein Kuroiwa discloses the metal electrode comprising ruthenium (Ru) or iridium (Ir).

Regarding claim 54, Kuroiwa discloses (see, for example, FIG. 10) a DRAM (integrated circuit structure) comprising a substrate assembly including a substrate (silicon containing region) 101, transfer gate transistor (active device) 103b, and a plug (interconnect) 111 including a ruthenium silicide layer 132.

Regarding claim 56, Kuroiwa discloses a metal electrode (conductive contact material) 130.

Regarding claims 58-62 and 64-68, Kuroiwa discloses the ruthenium silicide layer (conformal layer) 132 within an opening of the insulating film 110. The aspect ratio (ratio of height to width) is clearly greater than 1.

Regarding claim 63, Kuroiwa discloses (see, for example, FIG. 10) a capacitor comprising a metal electrode (first electrode) 130, capacitor dielectric film (high dielectric material) 115, upper electrode (second electrode) 116, and ruthenium silicide layer (diffusion barrier layer) 132.

10. Claims 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Aoyama et al. '307 as applied to claims 48, 49, and 54-68 above, and further in view of Matsubara et al. 5,122,923. Kuroiwa in view of Aoyama does not disclose the first electrode comprising one or more additional conductive layers. However, it was well known in the art at the time of invention to use multiple layers in the electrodes of a capacitor. In column 4, lines 25-27, Matsubara discloses a lower electrode comprising multiple layers of ruthenium, ruthenium oxide, ruthenium silicide and stacked structures consisting of these materials. It would have been obvious to one of ordinary skill in the art at the time of invention to have the first electrode comprising one or more additional conductive layers in order to form a bottom electrode, and since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis paper Co. vs. Bemis Co.*, 193 USPQ 8.

### **Product-by-Process Limitations**

11. While not objectionable, the Office reminds Applicant that “product by process” limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or *otherwise*. Note that applicant has the burden of proof in such cases, as the above case law makes clear. Thus, no patentable weight will be given to those process steps which do not add structural limitations to the final product.

The limitation “chemical vapor codeposited” merely recites a method of forming and does not deviate from the **structure of a diffusion barrier made of RuSi<sub>x</sub>**.

### ***Response to Arguments***

12. Applicant's arguments with respect to claims 45-68 have been considered but are moot in view of the new ground(s) of rejection.



**INFORMATION ON HOW TO CONTACT THE USPTO**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 571-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee  
May 31, 2004

A handwritten signature in black ink, appearing to read 'B. William Baumbister', with a stylized flourish at the end.

**B. WILLIAM BAUMBISTER  
PRIMARY EXAMINER**